SITE PREPARATION

VarioLas Standard ECO/PRO

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1 INTRODUCTION

This Site Preparation Manual is part of the instruction manual for the VarioLas Standard ECO/PRO. The instruction manual is designed to familiarize the user with the VarioLas Standard ECO/PRO system and its designated use. It contains important information on how to install, operate and service the system safely, properly and most efficiently. Observing these instructions helps to avoid danger, reduce repair costs and downtimes and increase the reliability and lifetime of the system.

The VarioLas Standard ECO/PRO system is a subsystem within an OEM device. Consequently, the instruction manual is to be used in conjunction with other instruction manuals that describe the complete system or further system elements. In addition, it is to be supplemented by the respective national rules and regulations for accident prevention and environmental protection.

The instruction manual for the VarioLas Standard ECO/PRO system is subdivided into the following separate manuals:

– User Manual

– Site Preparation Manual

Each manual has been prepared for a specific target audience and will be made available to this audience by Coherent, their authorized representative or the laser unit manufacturer (OEM).

1.1 Integrator / Customer Responsibilities

The VarioLas Standard ECO/PRO is an incomplete system, designed for use in combination with a Coherent laser device as a subsystem within a UV laser assembly.

The customer is responsible to take the following safety relevant measures to make sure that the VarioLas Standard comply with IEC 60825-1 (Safety of Laser Products). The measures shall be approved by the local Laser Safety Officer (LSO) before initial operation.

- Integration of the VarioLas Standard interlock switches into the interlock circuitry of the laser assembly.
- Fail-safe device according to IEC 60825-1 at each beam exit that gives a visible or audible warning when laser radiation is being emitted or the system is ready for immediate laser emission.

- Personal protective equipment (PPE) for all personnel working with or on the beam delivery module.
- Description of the workplaces to be taken by the personnel working with the beam delivery module.
- Purge gas supply for the beam delivery module.
- Ventilation and exhaust system for the working environment of the beam delivery module.
- Set up rules for safe handling of the interlock defeat keys.
- Power supply with appropriate electrical fuse protection (16 A), mains switch and Emergency Off (EMO) switch for the complete laser assembly.
- *Only **without** optional Class 1 Housing VarioLas installed:*
  Removing of the shielding plate at the beam exit opening.
  Now VarioLas Standard ECO/PRO does not comply with IEC 60825-1 any more as people can be exposed to laser radiation exceeding class 1 level!
  It is in the responsibility of the customer/integrator to make sure that the laser assembly as a whole comply with IEC 60825-1.
- *Only **without** optional Class 1 Housing VarioLas installed:*
  Light-tight connection of the beam delivery module to the substrate area.
- *Only with optional Class 1 Housing VarioLas installed:*
  Mounting of customer specific extensions onto the substrate stage and other modifications to the class 1 housing for adaption to customer's production conditions.
  If this requires that the VarioLas Standard is operated with opened class 1 housing, the laser assembly as a whole shall comply with IEC 60825-1 (Safety of Laser Products). In particular, this implies that personnel must not be exposed to laser radiation exceeding class 1 level.

Ensure that all laser safety regulations are complied with before working with the VarioLas Standard ECO/PRO.

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1.2 The Site Preparation Manual

This manual describes the required environmental conditions and external supplies for the VarioLas Standard ECO/PRO system.

1.2.1 Intended Audience

The Site Preparation Manual is intended for all persons that are to prepare the installation of or are to install and/or de-install the VarioLas Standard module.

1.2.2 Availability and Use

The Site Preparation must be made available to all OEM and end customer personnel instructed with the installation and de-installation of the VarioLas Standard system.

1.2.3 Numbering of Chapters, Pages and Instructions

The pages of this manual are numbered continuously. The page number appears in the lower outside corner of every page.

The chapters are numbered continuously. The name of the chapter appears in the upper outside corner of every even page. Each chapter ends with an even page number. Consequently, certain even pages at the ends of chapters will be intentionally left blank.

Each step within a procedure is sequentially numbered. Each procedure starts with the step number one.

1.2.4 Trademarks, Marks

The trademarks used in this manual are the properties of their respective owners and are used for identification purposes only:

- Coherent and the Coherent Logo are registered trademarks of Coherent Inc., USA
- LAMBDA PHYSIK, NovaTube, POWERLOK and TIMELOK are registered trademarks of Coherent GmbH as the legal successor of Lambda Physik AG, Germany
- VCR and Swagelok are registered trademarks of Swagelok Company, USA
- SMC pneumatic is a mark of SMC Corporation of America, USA
- SERTO is a registered trademark of Gressel AG, Switzerland

In the following sections of this manual, no mention is made of patents, trademark rights or other proprietary rights which may attach to certain words. The absence of such mention, however, in no way implies that the words in question are exempt from such rights.

1.2.5 Cited Standards

Unless otherwise stated, all technical standards cited in this manual relate to the latest version of the standard that is applicable at the date of the publication of this manual.

In many cases, the international standards (ISO and IEC standards) have been adopted wholly or in part by national or regional standards authorities and are known locally under the designation assigned by this authority. For instance, the IEC 60825-1 has been adopted by the European Committee for Standardization as the standard EN 60825-1 and, in turn, by various national standards authorities as standards such as DIN EN 60825 (Germany) and BS EN 60825 (United Kingdom). The exact content, number and revision date of the national standard may, however, vary from that of the corresponding international standard. For further information, please contact the publisher of the respective national standard.

1.3 Safety

1.3.1 Laser Safety Classification

IEC-60825-1, FDA 21 CFR 1040.10 and 1040.11 and ANSI Z-136.1 indicate the requirements and procedures that are to be followed to ensure the safe use of laser products. These standards and regulations classify each laser product according to the potential hazards arising in its use. In each case, the Laser Class indicates the accessible emission limit (AEL), i.e. the maximum emission level that humans can access.

The lowest Laser Class is Class 1 and the highest is Class 4:

– Class 1 laser products are laser products that are safe under reasonably foreseeable conditions of operation.

– Class 4 laser products are laser products that permit human access to emission levels that represent an acute hazard to the eyes and skin from direct and scattered radiation.

Within this classification, excimer lasers are class IV lasers. They must be regarded as a potential hazard to the human operator.

The laser beam must also be regarded as a potential fire hazard.

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1.3.2 Safety Information

The Safety Chapter of the separate User Manual describes the physical hazards related to the excimer laser device, the means of protection against these hazards and the safety features incorporated in the design of the laser device.

This Safety Chapter must be read by all persons entrusted with any sort of work on the laser device. Never start to follow the procedures detailed in this manual unless you have read and fully understood the information in the Safety Chapter.

1.3.3 Signal Words and Symbols in this Manual

The VarioLas Standard documentation may contain sections in which particular hazards are defined or special attention is drawn to particular conditions. These sections are indicated with signal words in accordance with ANSI Z-535.6 and safety symbols (pictorial hazard alerts) in accordance with ANSI Z-535.3 and IEC 7010.

1.3.3.1 Signal Words

Four signal words are used in the VarioLas Standard documentation: DANGER, WARNING, CAUTION and NOTICE.

The signal words DANGER**,** WARNING and CAUTION designate the degree or level of hazard when there is the risk of injury:

DANGER
Indicates a hazardous situation which, if not avoided, will result in death or serious injury.

WARNING
Indicates a hazardous situation which, if not avoided, could result in death or serious injury.

CAUTION
Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.

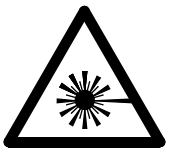
The signal word “NOTICE” is used when there is the risk of property damage:

NOTICE
Indicates practices not related to personal injury.

Messages relating to hazards that could result in both personal injury and property damage are considered safety messages and not property damage messages.

1.3.3.2 Symbols

The signal words **DANGER**, **WARNING** and **CAUTION** are always emphasized with a safety symbol that indicates a special hazard, regardless of the hazard level:



This symbol is combined with one of the signal words **DANGER**, **WARNING** or **CAUTION** to indicate a hazardous situation caused by laser radiation.

This symbol is combined with one of the signal words **DANGER**, **WARNING** or **CAUTION** to indicate a hazardous situation caused by general circumstances.

1.4 Laser Terminology

The ISO 11145 (“Optics and Optical Instruments - Lasers and Laser Related Equipment - Vocabulary and Symbols”) contains a list of laser terminology (for more information, see the User Manual):

– Laser
  Consists of an amplifying medium capable of emitting coherent radiation with wavelengths up to 1 mm by means of stimulated emission.

– Laser Device
  A laser, where the radiation is generated, together with essential additional facilities that are necessary to operate the laser, e.g. cooling, power and gas supply.

To prevent misunderstandings, the VarioLas Standard documentation strictly differentiates between “laser” and “laser device”. Thus “start laser device” means that the power is off and shall be turned on. To “start the laser” means to switch on the laser beam and start laser operation.

In addition to the terminology used by ISO 11145, IEC 60825-1 uses the term “laser product”. This term relates to any product or assembly of components which constitutes or is intended to incorporate a laser. In other words, the term “laser product” can be used in conjunction with any of the definitions contained in ISO 11145.

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1.5 Units of Measurements

In this manual, units of measurement are used according to the metric system and the international system of units (SI), e.g. meter, millimeter, square meter, cubic meter, liter, kilogram, bar, pascal.

Temperatures are primarily indicated in degrees celsius (°C).

The water hardness is indicated in parts per million (ppm; American Hardness).

1.6 Conversion Tables

Measurements

Listed below are the units of measure used in this manual and their equivalents according to the SI standard:

1 meter (m)	=	39.37 inches (in)
1 meter (m)	=	3.28 feet (ft)
1 centimeter (cm)	=	0.3937 inch (in)
1 square meter (m^2)	=	1550 square inches (in^2)
1 square meter (m^2)	=	10.76 square feet (ft^2)
1 cubic meter (m^3)	=	35.31 cubic feet (ft^3)
1 liter (l)	=	0.264 US gallons (gal)
1 kilogram (kg)	=	2.20 US pounds (lbs)
1 bar	=	100,000 Pascal (Pa)
100,000 Pascal (Pa)	=	14.50 pounds force per square inch (lbf/in^2)

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1.7 Feedback Regarding Documentation

If you have any comments regarding the documentation provided to you, please contact us.

When you contact us, please provide us with

– The document code or the part number and revision

– The date of issue

– The page number, section number and, where applicable, the procedure step number

– A description of any errors

– A proposal for improvements

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2 TRANSPORT AND STORAGE

If the system is to be temporary stored before installation, the storage area has to meet the requirements specified in this section.

NOTICE
Incorrect transportation and storage can cause serious damage! Always observe the conditions specified in this chapter when transporting or storing the system.

2.1 Climatic Requirements

The following climatic conditions must be maintained while transporting and during temporary storage of the system:

Temperature	
- Temperature range	-20 °C to 50 °C (-4 °F to 122 °F) 20 °C (68 °F) recommended
- Max. temperature gradient	5 °C/h
Humidity	less than 70 % RH
Ambient air pressure range	650 mbar to 1070 mbar
Max. permissible acceleration	
- measured on system	4 G
- measured on crate	10 G

The system can be transported by airfreight.

It is important that the units are not subjected to rapid changes in temperature or relative humidity.

2.2 Handling

The mechanical requirements of the system are such that the parameters specified in IEC 60721-3-1 and IEC 60721-3-2, class 2M1 (A through H), must be complied with during temporary storage as well as transportation.

2.3 Transport Dimensions and Weight

The system modules are packed in a container. The dimension and weight is indicated in the table below:

System with rigid transport packaging:

- Length	3580 mm (140.9 in.)
- Width	1380 mm (54.3 in.)
- Height	1860 mm (73.2 in.)
- Gross weight[1]	approx. 830 kg (1830 lbs)

System without rigid transport packaging:

- Length	3366 mm (132.5 in.)
- Width	1210 mm (47.6 in.)
- Height	1596.5 mm (62.8 in.)
- Weight[1]	approx. 420 kg (926 lbs)

1. The exact weight depends on the integrated options

2.4 Floor Loads

NOTICE
All floors on the proposed transport route or at the proposed storage / installation location must be checked to ensure that they can withstand the weight of the system.

It is the responsibility of the customer to provide Coherent and/or the OEM manufacturer with:

- Accurate information regarding floor loading capabilities. This information is needed to determine the type of transportation to be used within the production facility.
- Elevator loading capacities. When elevator transport is intended, the loading capability of the elevator must be verified.

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2.5 Internal Transport

WARNING
Risk of crushing!
The system together with its accessories and the rigid transport packaging weighs approx. 830 kg (1830 lbs).
Prevent tipping or dropping during lifting and transportation.

When lifting and transporting the system and its components always follow all standard safety precautions and practices for the transportation and handling of heavy equipment. Suitable air cushion pallets, a suitable fork-lift truck or similar device is required to lift and transport the system. Ensure that the fork length and lifting capacity is sufficient to safely lift and transport the system in the respective packaging stage.

All passageways, corridors and access points along the transport route have to have sufficient clearances to enable the safe transportation of the system in the respective packaging stage. This is particularly important after the removal of the rigid transport packaging.

2.6 Temporary Storage

NOTICE
Always store the packaging containing the system under the conditions specified in Section 2.1. The system must never be stored in the open air nor in any structure that does not fully shield it from the elements.

The space allocated for temporary storage must be sufficient to store the system and accessories in the respective packaging. Take into account the packaging configuration (see Section 2.3 on page 10). Provision must be made to allow adequate access to remove the system and accessories when required.

3 SAFETY EQUIPMENT REQUIREMENTS

This chapter provides an overview of the safety equipment that is required to operate the system. This consists of personal protective equipment (see Section 3.1) and fixtures at the installation site (see Section 3.2).

Specifications listed in this chapter indicate **maximum values** required for ordering the safety equipment. They do not indicate performance values that can be typically attained under normal working conditions.

The specific hazards inherent to the system and the measures that are to be taken to minimize these hazards are discussed in detail in the Safety chapter of the separate User Manual.

3.1 Personal Protective Equipment

During normal operation and routine set-up (e.g. alignment) of the VarioLas Standard, only the personal protective equipment (PPE) that is generally required for excimer laser systems is needed. This PPE is described in the laser device's User Manual.

When installing or de-installing the VarioLas Standard or its primary system modules, additional PPE (e.g. protective footwear) is required for the safe handling of heavy loads. For additional PPE requirements, strictly follow all locally applicable regulations.

3.2 Plant Requirements

This section describes the measures that are required to safely install and integrate the VarioLas Standard into its working environment.

3.2.1 Hardwired Interlock Circuit

According to IEC 60825-1, each laser product shall be contained in a protective housing that prevents human access to laser radiation in excess of Class 1 levels. The housing of the complete laser system into which the VarioLas Standard is integrated should be engineered to fulfill this requirement during normal operation sequences when laser radiation is being emitted.

At time of delivery, the basic configuration of the VarioLas Standard ECO/PRO module does not comply with the International Electrotechnical Commission standard IEC 60825-1 (“Safety of laser products”) as the working area on the substrate stage is not covered and non-interlocked. The system integrator is responsible to install the necessary devices (e. g. optional Coherent Class 1 housing and Safety Interlock Circuit) to ensure compliance of the laser product with IEC 60825-1.

The access panels that are intended to be removed or displaced during maintenance or operation (e.g. to exchange the workpiece) shall be provided with a safety interlock. The VarioLas Standard can be equipped with an interlock connection module that enables integration into the EMERGENCY OFF or EMERGENCY STOP circuit of the complete laser system.

3.2.2 Laser Area Warning Signs

Appropriate warning signs according to locally applicable standards (e.g. IEC 60825-1) are required to indicate the boundaries of the laser enclosed area.

A laser radiation warning lamp located outside the laser enclosed area has to light whenever laser radiation is being emitted.

3.2.3 Fire Extinguisher

Always keep a fire extinguisher in the area of the laser device. The fire extinguisher should be suitable for fighting “shock risk” classes of fire and be chosen according to local fire safety regulations. For further information, consult the fire safety officer that is responsible for the installation site.

3.2.4 Seismic Protection

If the system is to be installed in an area that is susceptible to seismic activity, appropriate protective devices have to be fitted (see Section 4.2.3 on page 16).

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4 FACILITIES

This chapter details the facilities that are required at the customer's site and includes details of supplies, connections and space requirements.

4.1 Environment

It is essential that the site chosen for the installation of the system meets the specified environmental conditions.

4.1.1 Operating Environmental Conditions

Temperature:	
- Temperature range	15 °C to 25 °C (59 °F to 77 °F)
- Max. temperature gradient	2 °C/h
Relative humidity	30 % RH to 70 % RH
Barometric pressure:	
- Max. pressure gradient	10 mbar/h
Contamination level	Class 100’000 or better

4.1.2 Electro-Magnetic Compatibility

The laser device complies with the following standards regarding Electro-magnetic Compatibility (EMC):

– IEC 61000-6-4: Generic emission standard for industrial environments

– IEC 61000-6-2: Generic immunity standard for industrial environments

– *For the types of tests not covered by IEC 61000-6-2:*
IEC 61000-6-1: Generic immunity standard for residential, commercial and light industry

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4.2 Facility Requirements

4.2.1 Floor Requirements

The floor must be capable of sustaining the weight of the fully configured system. The fully configured system weighs approx. 420 kg (926 lbs).

4.2.2 Lifting Means

To safely move the system in its rigid transport packaging to the required location, a suitable transport device (e.g. fork lift truck) must be available. For more information about the system weight and dimensions with and without packaging, see Section 2.3 on page 10.

NOTICE
Risk of damage!
Never lift the VarioLas Standard after screwing in any ring lugs into threaded holes in the plates or optics frame. Due to the VarioLas Standard' weight lifting it using ring lugs causes tensions to the module and the ring lugs are exposed to shearing forces and can break.

For lifting and moving the unpacked module, appropriate lifting means have to be used:

- Lifting device (e.g. crane)
- Load-carrying equipment (e.g. cross bars)
- Hoisting equipment (e.g. steel chains, lifting belts)

The complete responsibility for choosing the appropriate lifting means lies entirely with the customer/system integrator.

4.2.3 Seismic Protection

For installations in areas that are susceptible to seismic activity, the end user is responsible for appropriately securing the system within their facility.

The end user is to make provision for:

– anchors that prevent movement or overturning of the system during a seismic event.

– suitable strain relief devices for all supply lines. These are to control the risks through leakage or escape of gases, liquids and electricity etc. during a seismic event.

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For the exact configuration of the protective devices, local regulatory requirements are to be followed and the site vulnerability of the facility (e.g. local soil conditions and building design) is to be considered.

4.3 Gases

The purge gas is required for purging the beam path and optics. The flow is to be controlled by flow meters.

As the quality of the purge gas is critical to ensure correct performance of the system, only use gases corresponding with the specifications indicated in this section.

NOTICE
A) The usage of boiled-off nitrogen is recommended.
B) Only use gas cylinders with a remaining pressure of at least 20 % of the initial value.

Coherent recommends to use the gas cylinder for max. two years.

First Failure Safety

The integrator has to pay special attention to first failure safety in accordance with the Pressure Equipment Directive 97/23/EEC. For this purpose an appropriate overpressure release valve has to be installed in the purge gas system by the integrator. The triggering pressure for the overpressure release valve must be set according to the value indicated in the table below. This ensures that the purge gas pressure in the module housing will never exceed the specified gas pressure value.

Triggering pressure for the overpressure release valve	1.05 bar (abs.)

Never operate the VarioLas Standard ECO/PRO and optional accessories at purge gas pressures higher than specified as this will significantly increase the risk of bursting the housing. Ensure that the overpressure in the housings never exceeds 30 mbar and that the purge gas outlets are open.

Purge Gas

Type of gas	Nitrogen
Purity	99.999 % (5.0; boil off quality)
Max. H_2O fraction	1.0 ppm

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Gas inlet pressure	max. 1.05 bar (abs)
Flow rate	2.0 l/min to 4.0 l/min (recommended); a slight overpressure in the optics module should be achieved (max. 30 mbar)

The location and mechanical configuration of the gas connections is indicated in Section 5.4.1 on page 25.

4.4 Power Supply

To avoid the risk of electrocution and damaging of electrical components, the main laser device grounding connector must be connected with the equipotential bonding conductor of the building!

NOTICE
Improper installation can cause serious mains supply line damage. The mains supply line and main grounding line must be installed with strain-relief in a cable channel.

There are three different types of components regarding to their power supply:

– directly connected to the mains (Control PC, Monitor, ICM, ACM)

– internally low voltage powered by other components (energy monitor, attenuator stepper motor)

– powered by external power supplies provided with the component (safe shutter, observation LED, lens stabilization module).

None of these components need other supply voltage than 110 or 230 V AC. In total, the power consumption of all components listed below will never exceed 2000 watts.

Component	Supply Voltage	Current, Power
Control PC	110–240 VAC, 50 / 60 Hz	4 A
PC Monitor	110–240 VAC, 50 / 60 Hz	1 A
Electromagnetic Shutter	90–264 VAC, 50 / 60 Hz	50 W
Attenuator, Stepper Motor	via ACM	
Attenuator Control Module (ACM)	85–264 VAC, 50 / 60 Hz	max. 25 W
Energy monitor	24 VDC via ACM	
Substrate Observation LED	110–240 VAC, 50 / 60 Hz	6 W, Output 4.5 VDC
Interlock Connection Module (ICM)	85–264 VAC, 50 / 60 Hz	max. 60 W
Stage Controller Unit	[1]85–264 VAC, 50 / 60 Hz	700 W

1. For more details see the manufacturers specifications

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4.4.1 Control and Signal Lines

Figure 1 on page 20 shows the control and signal lines between all optional electrical Coherent components of the VarioLas Standard ECO/PRO. It is recommended to perform power supply of all electrical components via one single mains distribution (not part of delivery) as shown in Figure 1.

For information on how to connect optional components with user provided equipment, see Section 5.4.2 on page 27.

The motorized substrate stage's components and their electrical connections are not shown in Figure 1. For more information see the separate documentation provided by the manufacturer of the stages.

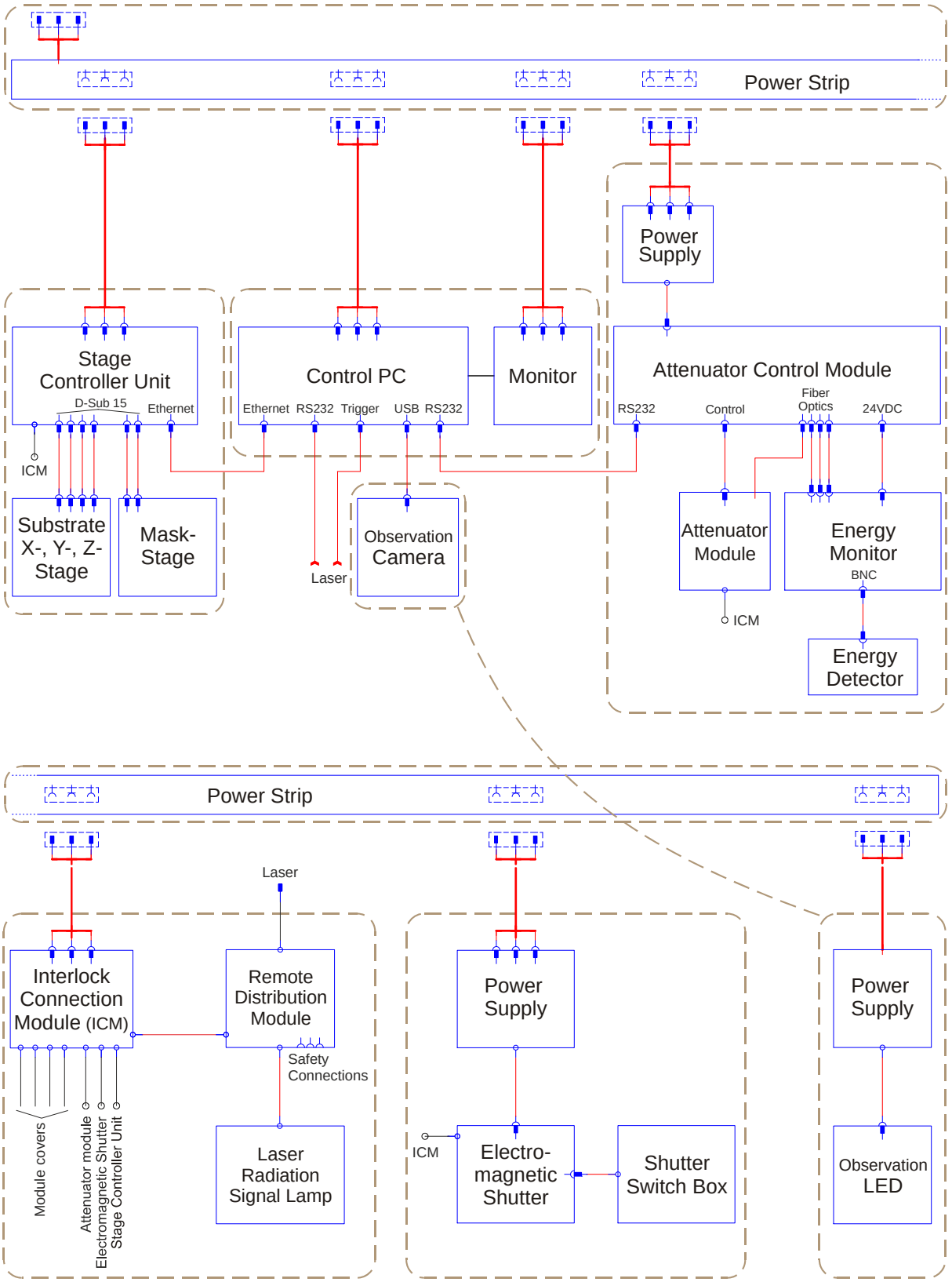

Figure 1: *Control and signal lines*

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5 CONNECTIONS / SPACE

This section specifies the space requirements and connections of the VarioLas Standard which are to be complied with to enable the system to be installed.

5.1 Definitions

The VarioLas Standard optics side designations as used in this chapter are defined in Figure 2.

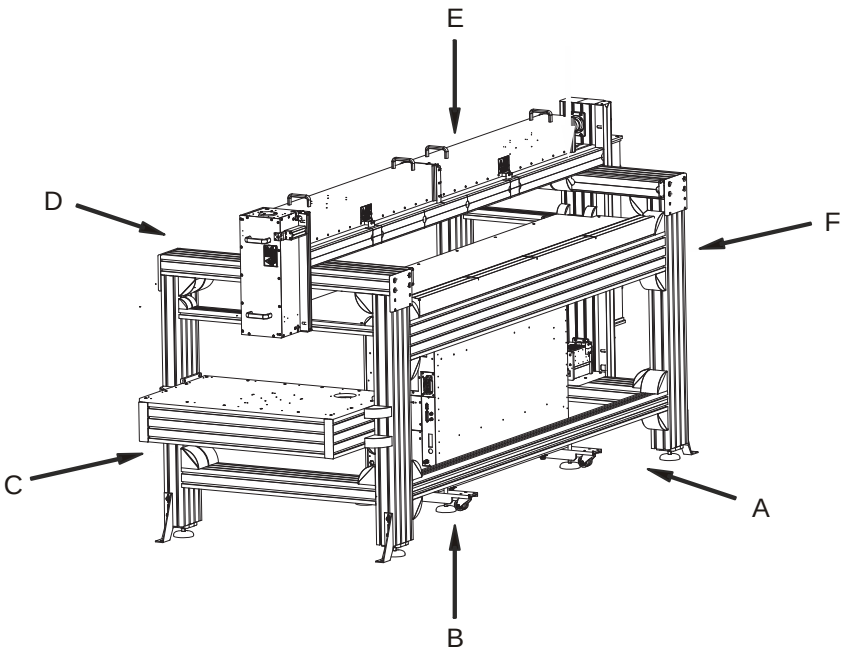

Figure 2: *Sides of system*

Key to Figure 2

A	Rear side
B	Bottom side
C	Right side
D	Front side
E	Top side
F	Left side

5.2 Physical Dimensions

The physical dimensions of the VarioLas Standard, with and without options installed, are indicated in the system drawings in the appendix of this manual. The laser (not part of delivery) is also shown to demonstrate its integration into the laser product.

The beam entry position is indicated in Section 5.2.1 on page 22.

The beam exit position is indicated in Section 5.2.2 on page 23.

Stage Support Structure

For the dimensions of the base plate, the position of the fixing screws (M6) for the Class 1 housing and the fixing screws (M6) for the substrate stage see the corresponding drawing in the appendix of this manual.

5.2.1 Entry Position

The height of the beam entry position of VarioLas Standard ECO/PRO is indicated in Figure 3.

The vertical position is 440 mm above floor level.

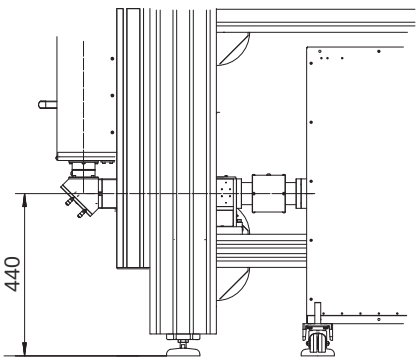

Figure 3: *Beam entry position*

5.2.2 Beam Exit Position

The position of the beam on the substrate is set 500 mm below the level of the optical axis inside the field lens module, see Figure 4. The vertical position is 974,5 mm above floor level.

Additionally, Figure 4 shows the distances to the stage support structure and the lower edge of the projection optics module.

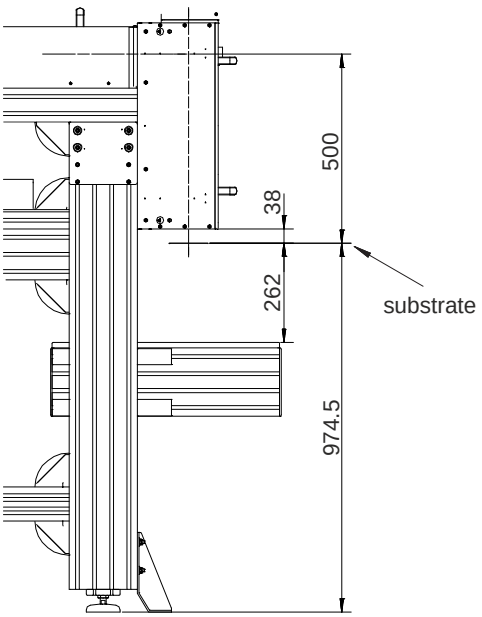

Figure 4: *Beam exit position*

5.3 Space Requirements

The system must be located in sufficient space for the module covers to be easily opened. The space required for the VarioLas Standard without options installed is shown in Figure 5 and Figure 6.

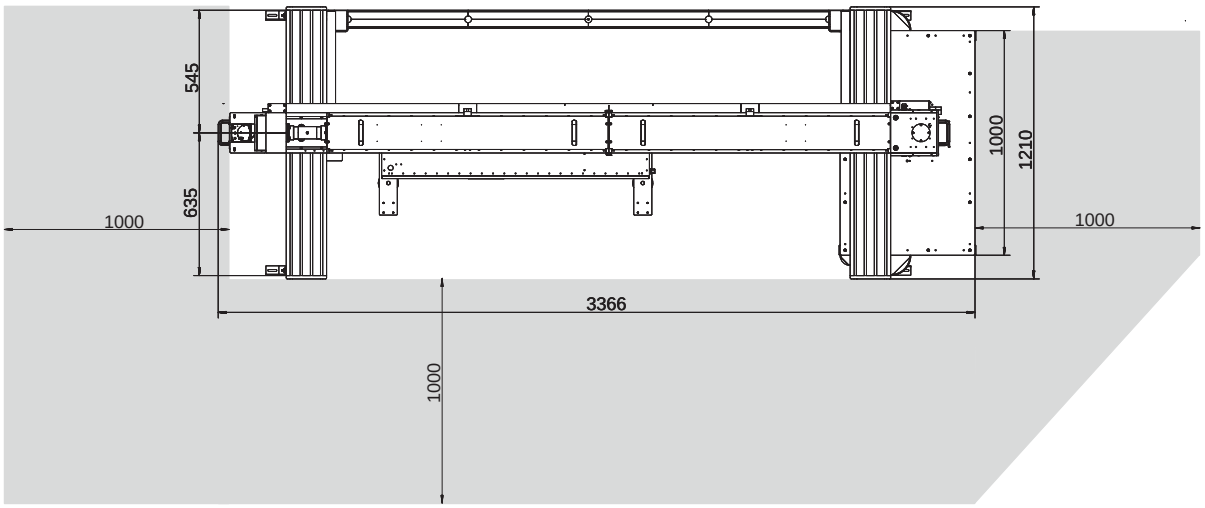

Figure 5: *Maintenance / service area system (top view)*

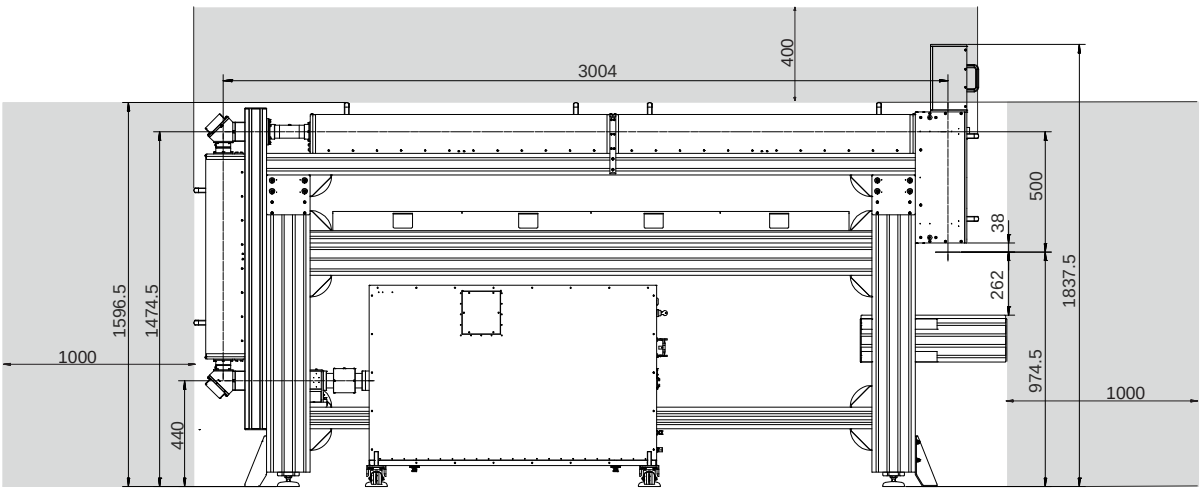

Figure 6: *Maintenance / service area system (front view with observation unit (optional))*

With options installed the service area is to be extended accordingly.

In addition to the system itself, sufficient space must be available for the 19” Control PC with 19” LCD Monitor. Other optional accessories can be placed onto the table plate of the VarioLas Standard.

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5.4 Connections

5.4.1 Purge Gas and Flow Meter Connections

Scale value	Flow rate
0.1	~ 0.1 l/min
0.2	~ 0.2 l/min
0.3	~ 0.3 l/min
0.4	~ 0.4 l/min
0.5	~ 0.5 l/min

Figure 7: *Flow meter*

The flow meter allows for flow regulation between 0.05 and 0.5 l/min according to the table.

For purging, the VarioLas Standard is equipped with purge gas fittings (see Figure 8 below) on the connection tubes (e.g. between attenuator and mirror module 1 or between mirror module 2 and the homogenizer module). Figure 9 on page 26 shows the position of the purge gas fittings and the position of the flow meter on the VarioLas Standard ECO/PRO. If nitrogen is used as purge gas the use of PE-hoses with 6 mm outer diameter and 4 mm inner diameter is recommended.

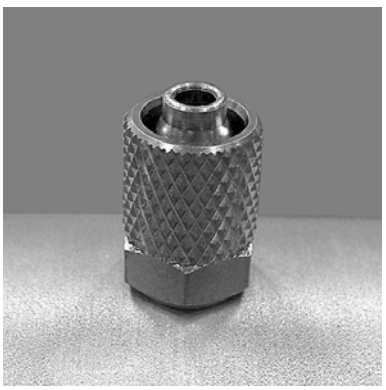

Figure 8: *Purge gas fitting*

The positions of all purge gas connectors are indicated in Figure 9.

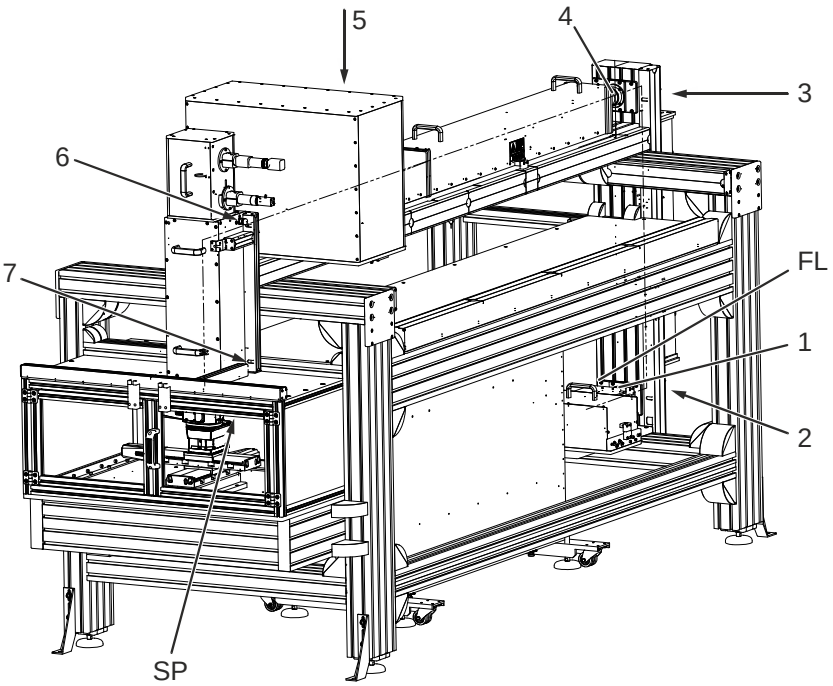

Figure 9: *Position of purge gas connections*

Key to Figure 9

1 Connection tube
2 Mirror module #1
FL Flow meter
3 Mirror module #2
4 Connection tube
5 Connection tube
6 Projection lens module
7 Projection lens module
SP Suction and purging unit

Specifications

Gas lines	6 mm or ¼", stainless steel, electropolished, free of burrs, inside & connection area (20 mm) chemically cleaned
Purge gas connector	SMC M-5H-6 (6 mm)

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5.4.2 Electrical and Signal Line Connections

The following sections provide information about connecting of Interlock switches, Attenuator Control Module, and Observation camera to user provided devices. However, it is recommended to use the optional Coherent components which meet the requirements best.

5.4.2.1 Serial Connections to Attenuator Control Modules

To enable remote control, the Control port of the Attenuator Control Module (ACM, see Figure 10, A below) has to be connected to the customer's control PC through a 1:1 serial interface cable as shown in Figure 1 on page 20.

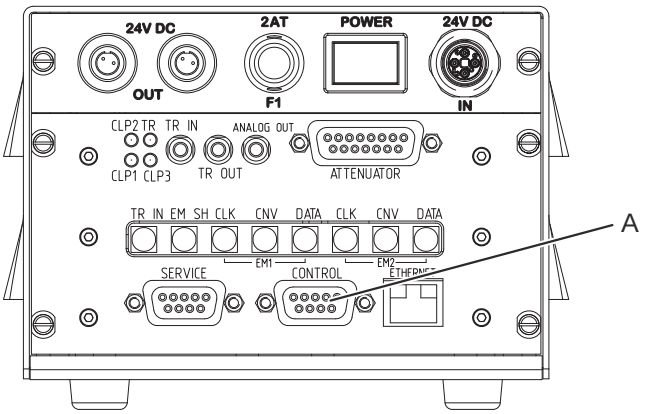

Figure 10: *Control port on front panel of ACM*

The interface settings are:

Baud rate:	9600 bps
Data bits:	8
Stop bits:	1
Parity:	OFF

The pin configuration is:

2	RxD
3	TxD
5	GND

For more information about the connection and installation of the ACM please refer to the corresponding component manual (P/N: D148046).

5.4.2.2 Control PC Connections

Figure 11 shows the connection sockets for control and signal lines to all VarioLas Standard components which are controlled or monitored by the PC.

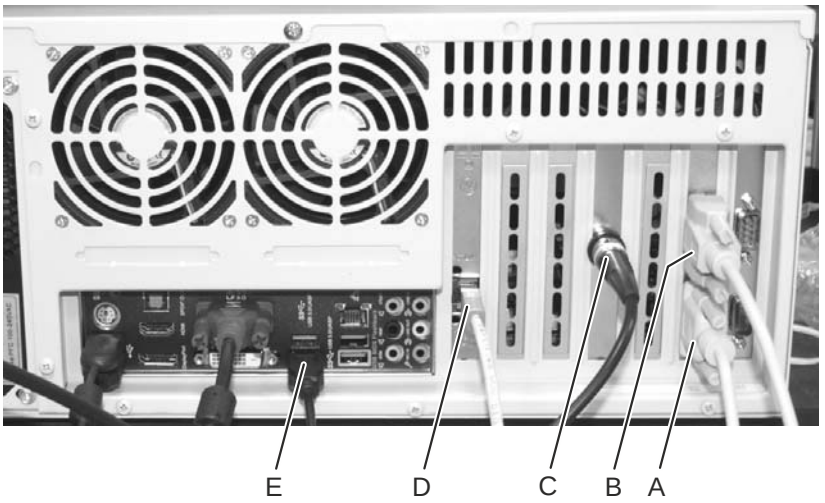

Figure 11: *Control PC connections*

Key to Figure 11

A	RS232, laser remote control
B	RS232, ACM remote control
C	Laser trigger connection
D	Ethernet, stage controller unit
E	USB, observation camera

5.4.2.3 Stage Controller Unit Connections

The stage controller unit (see Figure 12) serves for controlling three linear stages (2x substrate stages, 1x projection lens mount). For control, powering and limit switch monitoring various connection lines are used (A). For details please refer to the manufacturers documentation. Additionally an Interlock input (B) is provided to prevent inadvertent stage movement. Remote control is enabled via an Ethernet connection to the control PC (C).

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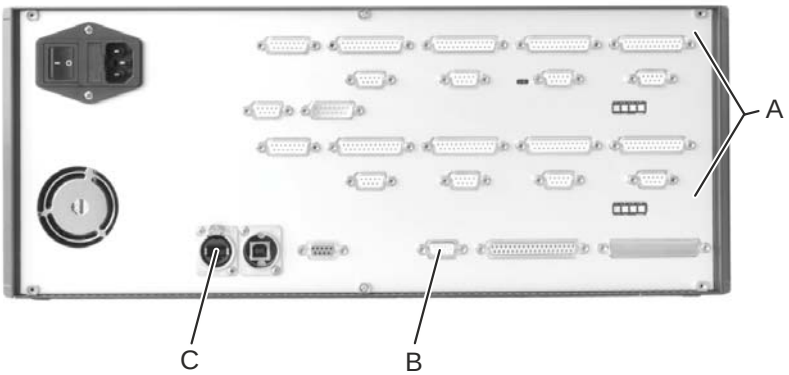


Figure 12: *Backplane stage controller unit*

Key to Figure 12

A Stage control/powering, limit switches
B Interlock connector
C Ethernet connector

5.4.2.4 Observation Camera Connection

The observation unit uses a CCD-camera which observes the workpiece through the projection lens. The camera should be connected to the customer's control PC (running the camera software) via an USB-interface cable. On the screen of the PC the camera pictures can be observed. For more detailed information on how to operate the camera see the manufacturer user manual delivered on a separate CD.

5.4.2.5 Interlock Switches

The beam path of the VarioLas Standard ECO/PRO is completely shielded and the removable covers of the optics modules as well as the attenuator module's housing cover are secured by interlock switches (see Figure 13 on page 30) which must be integrated into the overall interlock circuit by the system integrator. This has to ensure that the laser is switched off, when an interlock is activated. The interlock switches shall never be removed.

The positions of the VarioLas Standard cover interlock switches are indicated in Figure 14 on page 31.

Additional optional components which are equipped with interlock switches (e.g. class 1 housing), must also be connected with the overall interlock circuit to ensure a safe operation of the laser system.

The cover interlock switches have to shut off laser operation when activated to ensure that laser operation is disabled with unshielded beam path when connected to the laser device's external remote

interlock connector (for more information see the separate laser device's user manual). Opening one of the covers must activate the laser device's interlock circuitry which immediately switches off the high voltage power supply of the laser device and therefore stops lasing action.

Figure 13: *Interlock switch (example)*

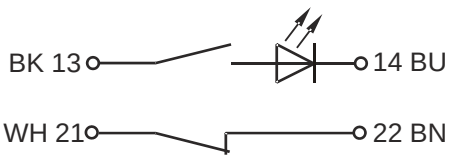
The VarioLas Standard ECO/PRO is designed for operation with contact-free magnetic switches. Each switch set consists of two parts: a magnetic actuator and a contact sensor which is provided with a 10 m connection cable. For more information about the cable wiring see Section 4.4.1 on page 19.

Specifications

Max. switching voltage:	24 VDC
Max. switching current:	10 mA
Max. switching capacity:	240 mW
Category:	3 according to EN 954-1

Cable Connections

Cable Color	**Connection**
black (BK)	LED 13
blue (BU)	LED 14
white (WH)	Contact 21
brown (BN)	Contact 22



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Interlock switch positions

The interlock switches (IS) are numbered consecutively enable a clear assignment of the corresponding interlock.

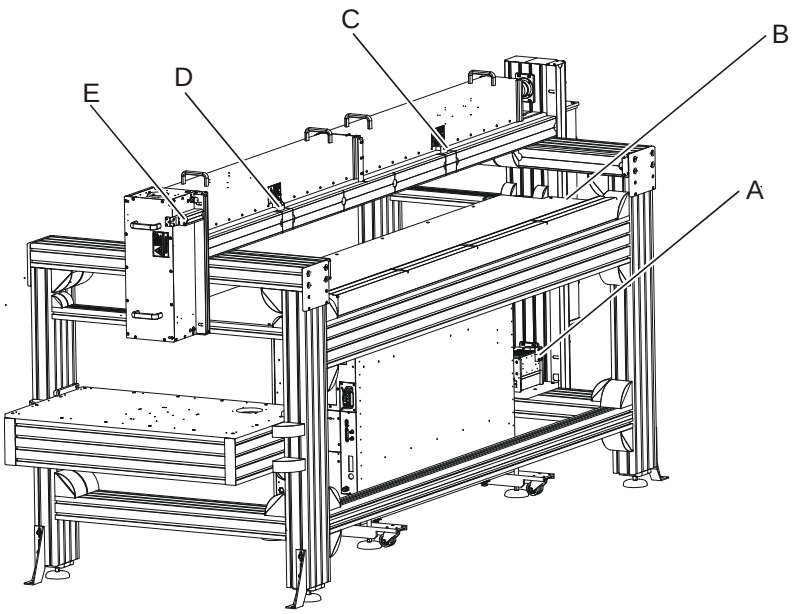

Figure 14: *Position of interlock switches (basic configuration)*

Key to Figure 14

	Interlock Switch	**Housing Cover**
A	IS5	Attenuator module
B	IS1	Telescope module
C	IS2	Homogenizer module
D	IS3	Field lens and mask module
E	IS4	Projection optics module

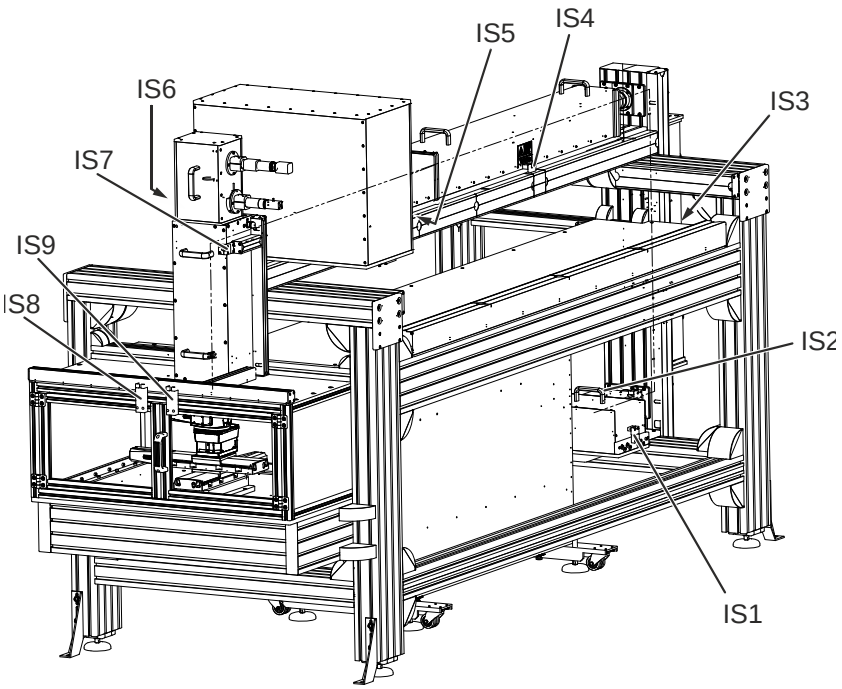

Figure 15: *Position of interlock switches (with installed options)*

Key to Figure 15

Interlock Switch	Housing Cover	ICM LED
IS1	Switching mirror module	1
IS2	Attenuator module	2
IS3	Telescope module	3
IS4	Homogenizer module	4
IS5	Energy detector module	5
IS6	Field lens and mask module	6
IS7	Projection optics module	7
IS8	Class 1 housing, left door	8
IS9	Class 1 housing, right door	9

5.4.3 Beam Delivery System

The responsibility for the correct and sufficient connection of the laser beam exit to the beam delivery system lies entirely with the supplier of the final equipment assembly.

The entire beam path of Class 4 lasers, including the target area, should be hermetically sealed by an enclosure equipped with interlocks that prevents operation of the laser system unless the enclosure is properly secured. The beam path shall, insofar as possible, be free of specular reflective surfaces and materials which would be combustible if irradiated by the beam. The supplier of the final equipment assembly should ensure after installation of the beam delivery system that no laser radiation exceeding maximum permitted

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exposure (MPE) values arises at the connection between the laser device and the beam delivery system. Measurements in accordance with statutory requirements must be carried out by an authorized body to ensure that the MPE-values are not exceeded.

6 DE-INSTALLATION / INSTALLATION

Purpose

De-install and install the VarioLas Standard ECO/PRO.

The VarioLas Standard consists of the main frame and the laser device.

Information about the installation of the VarioLas Standard ECO/PRO is given in Section 6.3 on page 37.

Preconditions for De-Installation

The following preconditions shall be fulfilled when de-installing the VarioLas Standard ECO/PRO:

- Transportation fill performed (see User Manual of the laser device)

6.1 Laser Device

Purpose

De-install the laser device

De-installing the Laser Device

In combination with the VarioLas Standard ECO/PRO, the laser device (see Figure 16, A) is mounted on two traverses (D).

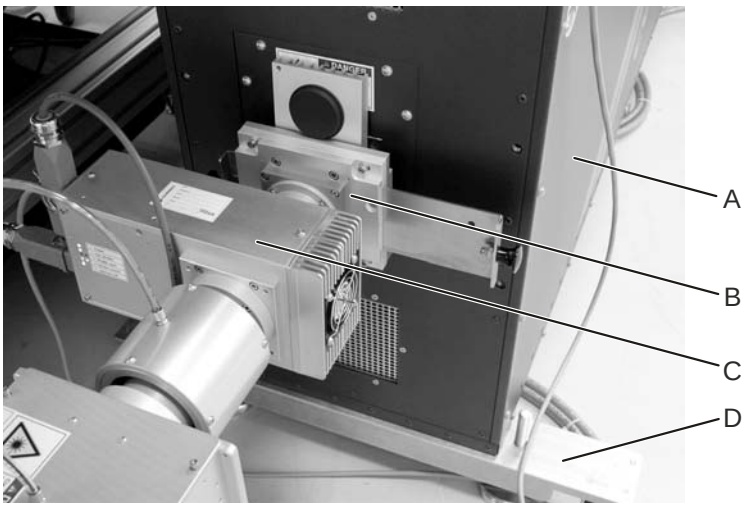

Figure 16: *Laser device before de-installation (example)*

1. Disconnect the mechanical shutter (B) from the laser device.
2. Disconnect the mechanical shutter from the Electromagnetic Shutter (see Figure 16, C).
3. Screw in the stabilizing feet of the traverse until the laser rests on the transport wheels.

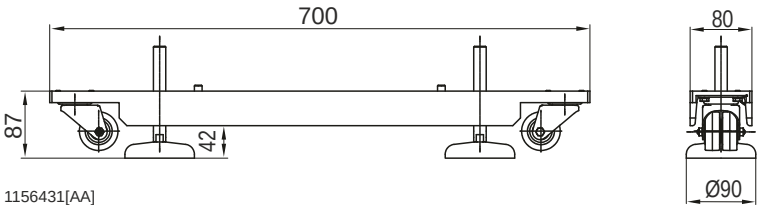

Figure 17: *Traverse for positioning the laser device*

4. Carefully pull the laser device out of the main frame.
5. Lift the laser device using a fork lift and unscrew the traverses.
6. Prepare the mechanical shutter and the traverses for shipping.
7. Proceed with the disconnection of the laser device as described in the separate laser device's Service Manual.

Transportation of the laser device is described in the separate laser device's Site Preparation Manual.

6.2 Main Frame with Optics Modules

Purpose

De-install the main frame with optics and prepare for transportation.

Tools and Materials

- Service tool kit
- Hoisting Equipment
- Lifting device

Preconditions

- Laser device removed from the main frame

Disconnecting the Main Frame with Optics Modules

The electrical modules supplied with mains voltage remain installed on the main frame.

1. Disconnect the mains voltage supply line.
2. Disconnect the purge gas line.

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3. Remove the following optics:
   - Attenuator
   - Telescope
   - Homogenizer
   - Field lens
4. Pack the removed optics into the designated boxes.
5. Disconnect the Electromagnetic Shutter and the tube shielding from the attenuator module.
6. Disconnect the control PC(s).
7. Disconnect the voltage supply cables from the supplied modules.
8. Package the disconnected accessories in appropriate cartons or boxes.
9. Coil the cables and secure them using cable ties (see Figure 18).

Figure 18: *Modules disconnected from voltage supply*

10. Protect the modules with bubble wrap.
11. Wrap the upper part of the main frame and all optics modules with clingwrap.
12. Remove the mounting brackets for floor fixation.

Transportation of the main frame without rigid transport packaging is described in Section 7.6.1 on page 46.

6.3 Installation

Install the VarioLas Standard in the reverse order.

7 MOVING AND UNPACKING

This chapter describes the internal transport and unpacking of the VarioLas Standard. After following all procedures detailed in this chapter, the VarioLas Standard is ready for connection at the installation location.

To ensure that the VarioLas Standard is moved and unpacked safely and that no damage occurs, strictly adhere to the requirements in this chapter. In addition, ensure that the requirements for transport and storage are complied with (see Section 2 on page 9).

Moving and unpacking the laser device is described in the separate laser device‘s Site Preparation Manual.

7.1 Safety Guidelines

WARNING
Risk of crushing!
The heaviest module of the VarioLas Standard weighs approx. 830 kg (1830 lbs) together with its rigid transport packaging and approx. 420 kg (926 lbs) without packaging.
Prevent tipping or dropping during lifting and transportation.

When externally or internally moving the VarioLas Standard and its components, always follow all standard safety precautions and practices for the transportation and handling of heavy equipment. Always use appropriate lifting equipment.

NOTICE
Risk of damage through shocks and excess vibration!
Shocks and excess vibration can damage sensitive and precision components of the VarioLas Standard, including its feet.
Avoid sudden shocks, especially when the VarioLas Standard is attached to the base plate of the rigid transport packaging.

Ensure that the VarioLas Standard is transported carefully, regardless of the packaging stage.

NOTICE
Risk of damage through excess tilting!
Keep the VarioLas Standard as horizontal as possible during transportation and installation. If tilting is necessary, ensure that the maximum permissible tilting gradients are not exceeded. Only tilt for short periods.

The arrow at the Tip'n'tell indicator turns to blue when the packaging is tilted approx. 60°.

7.2 Transport Packaging

This section describes the means of packaging of the VarioLas Standard to ensure safe shipment and delivery in the required condition.

NOTICE
Always retain the transport packaging to ensure optimum protection of the VarioLas Standard during sub sequent shipment.

The size, weight and configuration of the transport packaging is indicated in Section 2.3 on page 10.

Each VarioLas Standard has two-stage transport packaging:

– rigid transport packaging and

– anti-static (polyethylene) inner cover.

The two rigid transport crates (see Figure 19 and Figure 20) fully encapsulate the VarioLas Standard and inner cover. They consist of a plywood base pallet (B) and plywood upper panels (A) at the sides, front, rear and top.

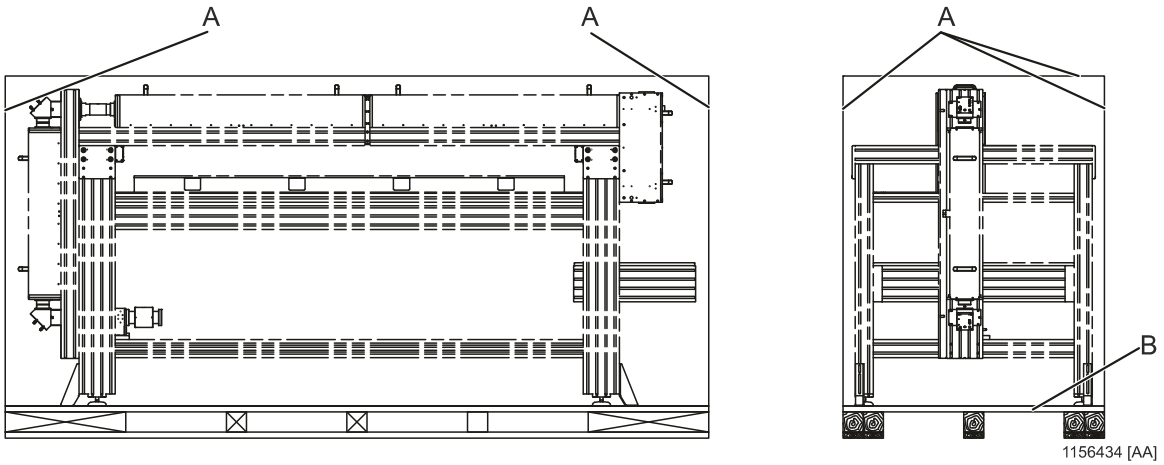

Figure 19: *Rigid transport packaging for main frame and accessories*

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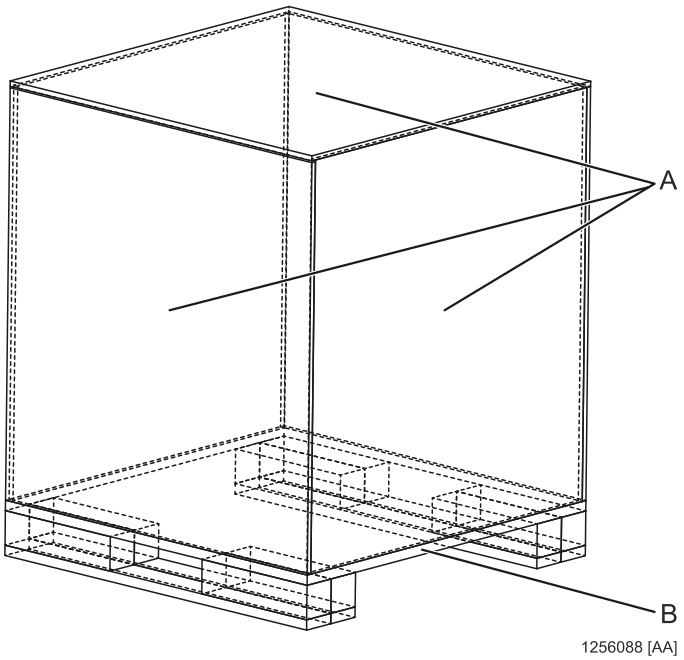

Figure 20: *Rigid transport packaging for base frame and class 1 housing*

The main frame is secured in position to the base plate by the four mounting brackets (see Figure 21 as an example).

Figure 21: *Main frame secured on base pallet*

The VarioLas Standard is to be stored in the rigid transport packaging. Remove the clingwrap immediately prior to installing the VarioLas Standard.

7.3 Transport / Lifting With Rigid Packaging

WARNING
Risk of crushing!
The heaviest version of the VarioLas Standard in its rigid transport packaging weighs approx. 830 kg (1830 lbs).
Prevent tipping or dropping during lifting and transportation.

A suitable fork lift truck or similar device is required to lift the VarioLas Standard. Ensure that the fork length and loading capacity is sufficient to safely lift the VarioLas Standard in its packaging. The dimensions and weight of the packed VarioLas Standard are indicated in Section 2.3 on page 10.

The VarioLas Standard can be lifted longitudinally from the side. Set the forks as far apart as possible to safely lift the VarioLas Standard.

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7.4 Initial Inspection of Delivery

Purpose

Check that no damage has occurred to the VarioLas Standard during transportation and that the shipment is complete.

To monitor the handling of the VarioLas Standard during transportation, the following indicators fixed to the rigid transport packaging:

- Two Shockwatch indicators (on the long side and short side; see Figure 22, B). These turn to red when subject to excess shocks.
- One Tip'n'tell indicator (on the short side; see Figure 22, A). The arrow of the Tip'n'tell indicator turns blue when the packaging has been exessively tilted.

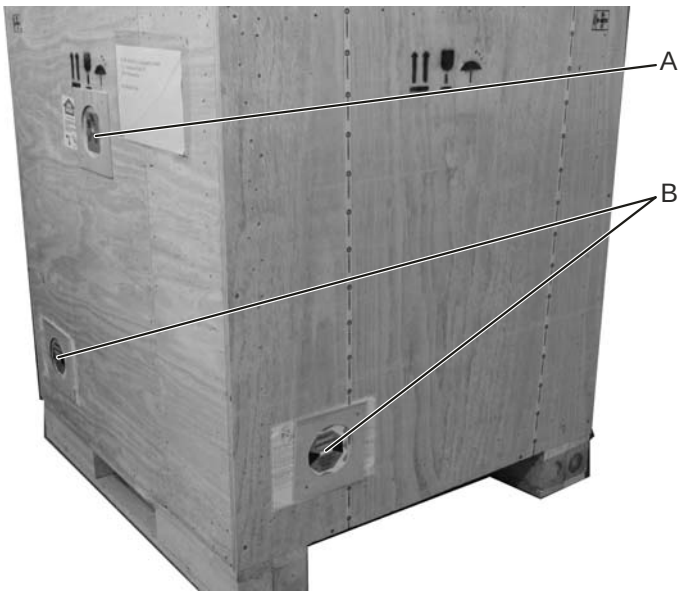

Figure 22: *Indicators on the rigid packaging*

Tools and Materials

- None

Initially Checking the VarioLas Standard Packaging

1. Ensure that none of the Shockwatch indicators on the rigid transport packaging have turned to red.

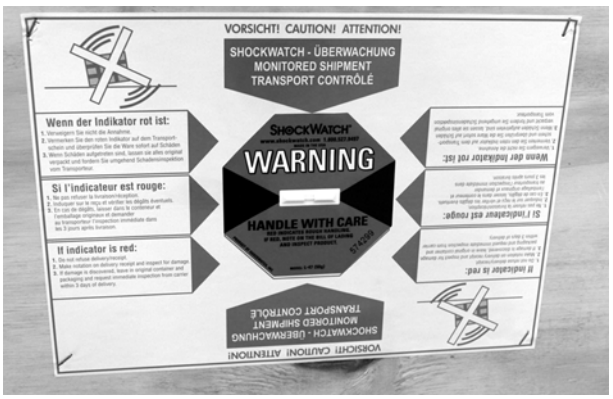

Figure 23: *Shockwatch indicator*

2. Ensure that the arrow of the Tip'n'tell indicator did not turn to blue.

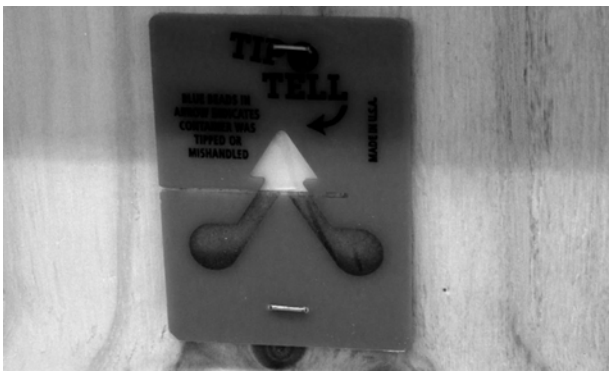

Figure 24: *Tip'n'tell indicator*

3. Inspect for visible signs of damage to the rigid transport packaging.

Checking the Contents of Shipment

4. Check the contents of the shipment against the Shipment Inspection Checklist (packing list) provided.
5. Sign the delivery note.

If any parts are missing, immediately contact Coherent. The contact address is indicated on the reverse side of the cover sheet of this manual.

Damaged Deliveries

If the initial inspection of the delivery indicates mishandling or tipping of the VarioLas Standard during transport, proceed as follows:

- Do not refuse the shipment.
- Make a corresponding notation on the delivery receipt document.
- If there are visible signs of damage, leave the VarioLas Standard in the original transport packaging and request immediate inspection from the carrier within three days of delivery. Take photographs of the damage.
- If there are no visible signs of damage to the packaging, remove the packaging and check for visible signs of damage to the VarioLas Standard.
- If there are signs of damage to the VarioLas Standard, immediately contact Coherent for further inspection and rectification. Take photographs of the damage.

7.5 Remove Rigid Packaging

Purpose

Remove of the top and side panels from the rigid transport packaging.

At the end of this procedure the VarioLas Standard remains attached to the base pallet and is protected by the inner cover.

Tools and Materials

- Suitable fork-lift truck
- Knife
- Cordless screw driver

Preparation

1. Using the fork-lift truck or appropriate device, move the VarioLas Standard to the location where it is to be unpacked.
2. Set down the VarioLas Standard in the unpacking location.

Removing the Rigid Packaging

NOTICE
The original packaging is needed to re-ship the VarioLas Standard. Remove and store the removed packaging in such a way that no parts are lost or damaged.

Storing the Transport Packaging

3. Stack the disassembled panels of the rigid transport packaging and accessory packaging onto the base pallet.

   When stacking, ensure that the outer cover does not become contaminated or damaged and that the inside surfaces of the panels cannot become contaminated.

7.6 Transport / Lifting Without Rigid Packaging

Purpose

Transport / lift the VarioLas Standard without rigid packaging.

Tools and Materials

- Fork lift suitable for at least 600 kg
- Crane suitable for at least 600 kg
- Four creeper dollies with mounting facility suitable for at least 600 kg

7.6.1 Main Frame

WARNING
Risk of crushing!
The main frame weighs approx. 420 kg (926 lbs) without packaging.
Prevent tipping or dropping during lifting and transportation.

NOTICE
Risk of contaminating or damaging the laser optics!
To avoid the formation of condensed water, ensure that the max. permissible temperature gradient (5 °C/h) is maintained while moving the VarioLas Standard from the storage area.

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Ensure that all passageways, corridors and access points have sufficient clearances. Pay particular attention to the clearances required to turn the VarioLas Standard. The dimensions of the VarioLas Standard are indicated in Section 5.2 on page 22.

Lifting with a Crane / Transport with Creeper Dollies

1. Unscrew the mounting brackets from the base pallet.
2. When using a crane, position the lifting harness or belt close to the lifting points indicated in Figure 25.

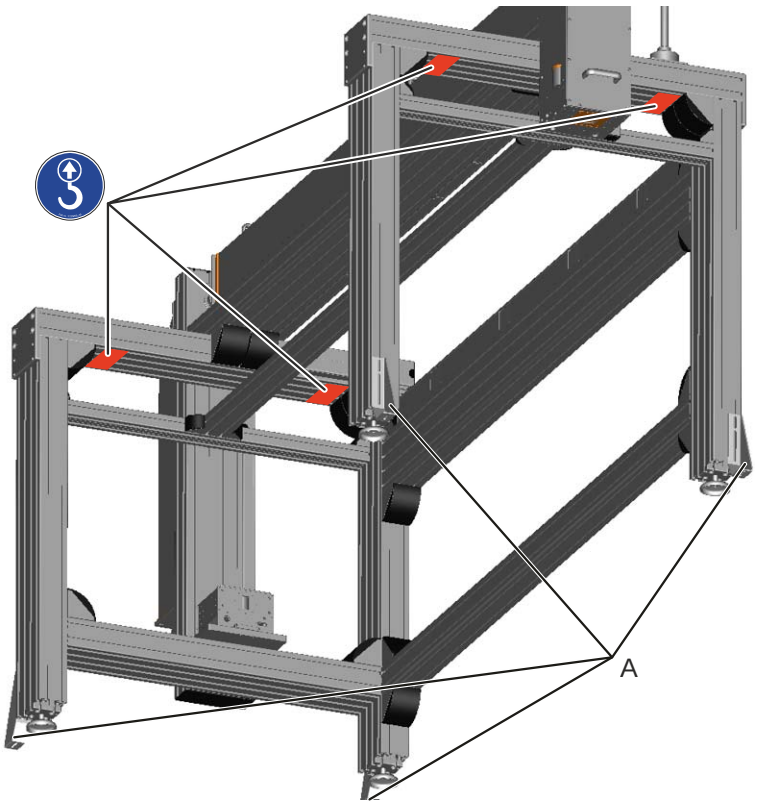

Figure 25: *Main frame - lifting points and mounting brackets*

3. Carefully lift the main frame with optics modules.

4. Carefully set down the main frame with optics modules onto the creeper dollies (see Figure 26).

Figure 26: *Lifting the main frame with a crane*

5. Fix the main frame to the creeper dollies.
6. Use the creeper dollies for further transportation.

Lifting with Fork Lift / Transport with Creeper Dollies

CAUTION
Risk of injury and/or damage!
The main frame with optics modules is top-heavy. When using the fork lift, ensure that the main frame does not topple.

1. Use the fork lift to carefully lift the main frame with optics modules.
2. Carefully set down the main frame with optics modules onto the creeper dollies for further transport.
3. Fix the mounting brackets (see Figure 25, A) to the creeper dollies.

7.7 Remove Clingwrap

Purpose

Remove the clingwrap from the VarioLas Standard and unpack the accessories.

Tools and Materials

- Knife for cutting sealing tape

Preparation

1. Move the VarioLas Standard and accessories to the installation area.

Removing the Inner Covers

NOTICE
The original packaging is needed to re-ship the VarioLas Standard. Store the removed packaging in such a way that no parts are lost or damaged.

2. Remove the tape that fixes the clingwrap to the VarioLas Standard and remove the clingwrap from the VarioLas Standard.
3. Take the accessories out of the packaging and carefully clean them as required.

8 QUICK REFERENCE / CHECK LIST

This section provides quick reference tables and a check list to ensure that the installation site is correctly prepared and the required utilities are obtained prior to installation of the laser device. The tables provide the specifications for all available versions and possible configurations of the VarioLas Standard.

If you have ordered the VarioLas Standard for the first time, please complete the pre-installation checklists in Section 8.1 and return them (by fax, eMail attachment or post) to the appropriate address indicated below to prevent unnecessary delays during installation.

EUROPE
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D - 37079 Göttingen, Germany

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Coherent Inc.
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Tel.: +81 (3) 5635-8770
Fax: +81 (3) 5635-8701
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Coherent Asia Korea
Eagle Town 1F,5F 278-20, Seongsu 2ga-3dong
Seongdong-Gu, Seoul, 133-832, Korea

Tel.: +82 (2) 460-7900
Fax: +82 (2) 460-7901
eMail: gtgkoreaservice@coherent.com

8.1 System Requirements

8.1.1 Utilities

Gas	Requirements	Checked		Further Information
		Yes	No	
Purge (purge gas for the beam path)				Section 4.3 on page 17
- Type of gas	Nitrogen			
- Purity	99.999 % (5.0; boil off quality)			
- Max. H_2O fraction	1.0 ppm			
- Gas inlet pressure	max. 1.05 bar (abs)			
- Flow rate	2.0 l/min to 4.0 l/min (recommended); a slight overpressure in the optics module should be achieved (max. 30 mbar)	—	—	
- Fittings	SWC ¼” (6 mm)			

NOTICE
If the remaining pressure drops below a critical value, the humidity in the gas cylinders may significantly increase. Therefore, Coherent recommends to exchange the gas cylinders at a remaining pressure of 20 % of the initial value.

Electrical Supplies	Requirements	Checked		Further Information
		Yes	No	
Power Supply Control PC[1]				Section 4.4 on page 18
- Voltage	110–240 VAC, 50 / 60 Hz			
- Current	4 A			
Power Supply PC Monitor[1]				
- Voltage	110–240 VAC, 50 / 60 Hz			
- Current	1 A			
Safe Shutter[1]				
- Voltage	90–264 VAC, 50 / 60 Hz			
- Power	50 W, Output 24 VDC			
- Connector	Harting 4-pin connector			
Motorized Attenuator Module[1]				
- Voltage	24 VDC			
- Current	420 mA			
- Connector	Shutter connector			
Attenuator Control Module (ACM)[1]				
- Voltage	100–240 VAC, 50 / 60 Hz			
- Power	12 W w/o energy monitor			
Energy Monitor[1]				
- Voltage	24 VDC feeded via ACM			
- Power				
Substrate Observation Unit[1]				
- Voltage	Mainy Miniature Power Supply 110–240 VAC, 50 / 60 Hz			
- Power	6 W, Output 4.5 VDC			
Interlock Connection Module (ICM)[1]				
- Voltage	85–264 VAC, 50 / 60 Hz			
- Power	max. 60 W			
- Connector	Harting			
Substrate Stage/Controller Unit[1]				
- Voltage	110–240 VAC, 50 / 60 Hz			
- Power	max. 700 W			

1. Optional component

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8.1.2 Environmental Conditions

Transport / Storage Conditions	Requirements	Checked		Further Information
		Yes	No	
Air temperature	-20 °C to 50 °C (-4 °F to 122 °F) 20 °C (68 °F) recommended			Section 2.1 on page 9
Max temperature change	5 °C/h			
Humidity	less than 70 % RH			
Ambient air pressure	650 mbar to 1070 mbar			
Max. permissible acceleration				
- On system	4 G			
- On crate	10 G			

Operational Conditions	Requirements	Checked		Further Information
		Yes	No	
Temperature range	15 °C to 25 °C (59 °F to 77 °F)			Section 4.1 on page 15
Max temperature change	2 °C/h			
Humidity	30 % RH to 70 % RH			
Max. pressure change	10 mbar/h			
Pollution	Class 100’000 or better			

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8.2 System Specifications

The following specifications refer to a VarioLas Standard ECO/PRO without optional components installed. With optional standard components or customer specific extensions the VarioLas Standard can have larger dimensions and can be much heavier.

8.2.1 Transport Dimensions and Weight

System with rigid transport packaging:

- Length	3580 mm (140.9 in.)
- Width	1380 mm (54.3 in.)
- Height	1860 mm (73.2 in.)
- Gross weight[1]	approx. 830 kg (1830 lbs)

System without rigid transport packaging:

- Length	3366 mm (132.5 in.)
- Width	1210 mm (47.6 in.)
- Height	1596.5 mm (62.8 in.)
- Weight[1]	approx. 420 kg (926 lbs)

1. The exact weight depends on the integrated options

8.2.2 Space Requirements

Maintenance area (l × w × h)	5300 × 2210 × 2000 mm (209 × 87 × 79 in.)

8.2.3 Beam Entry Position

Height above floor level	440 mm (17.3 in.)

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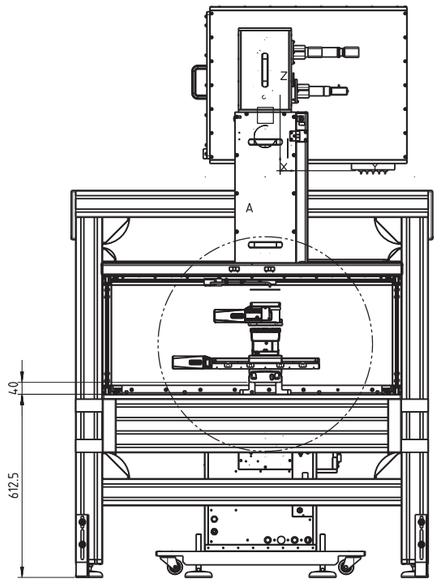
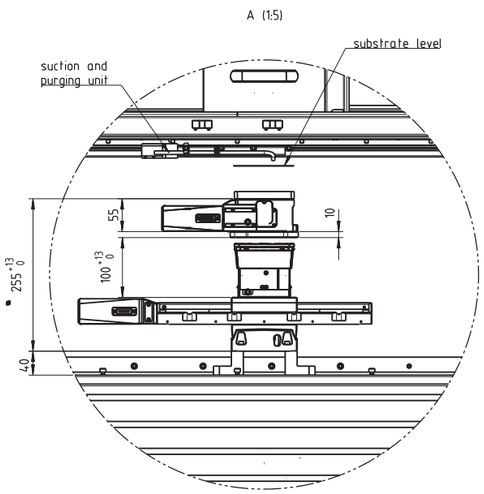
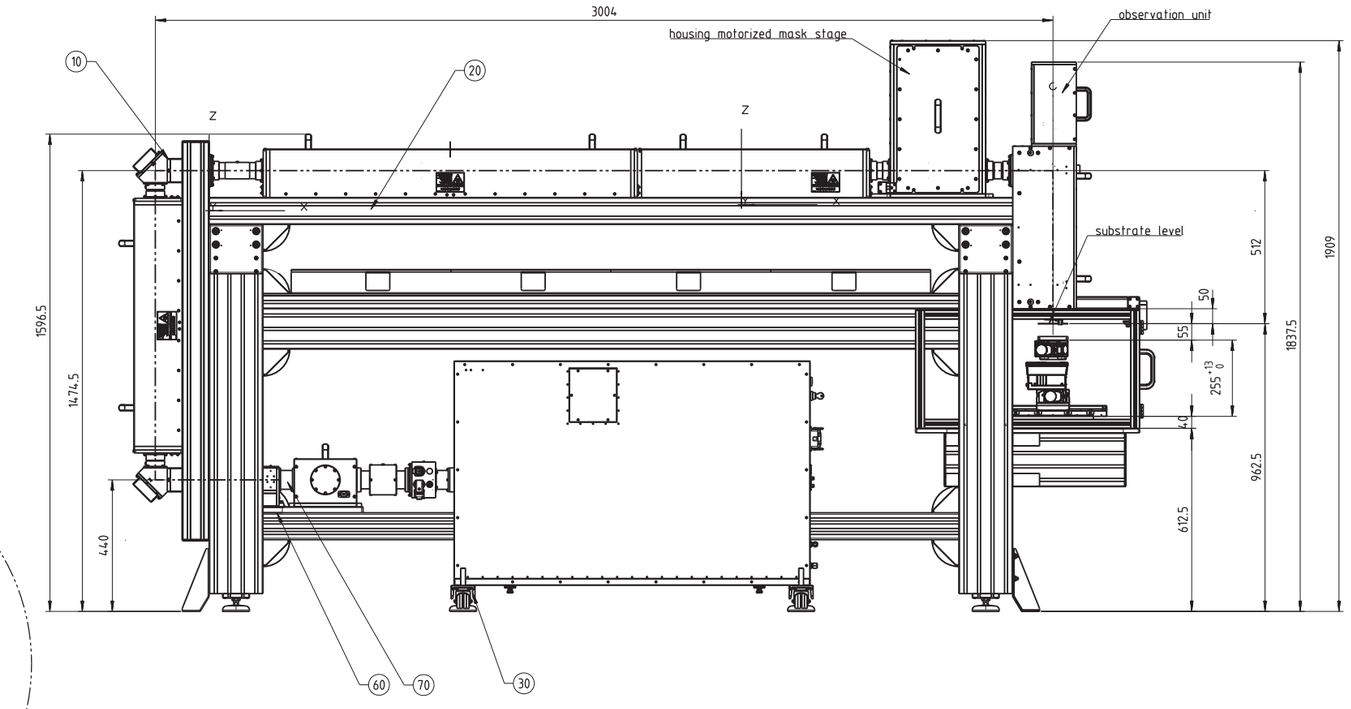
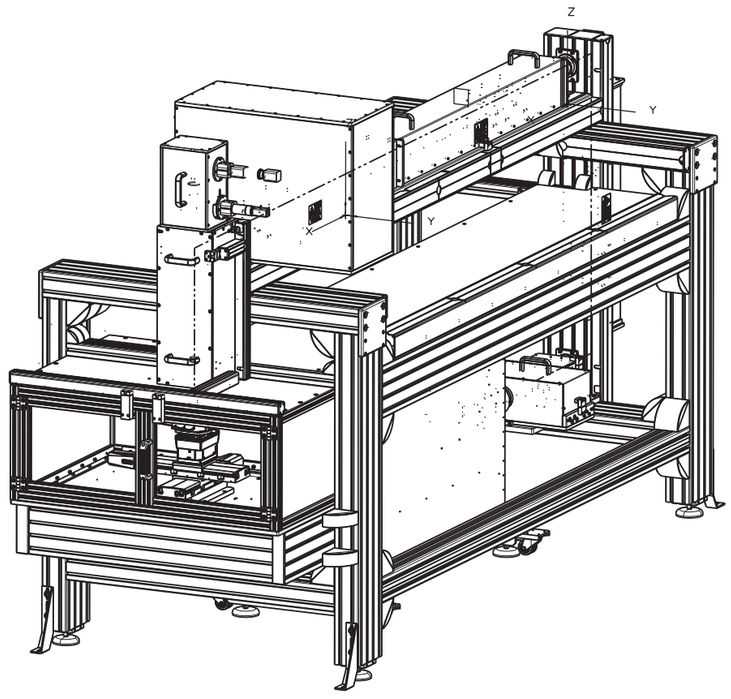
APPENDIX

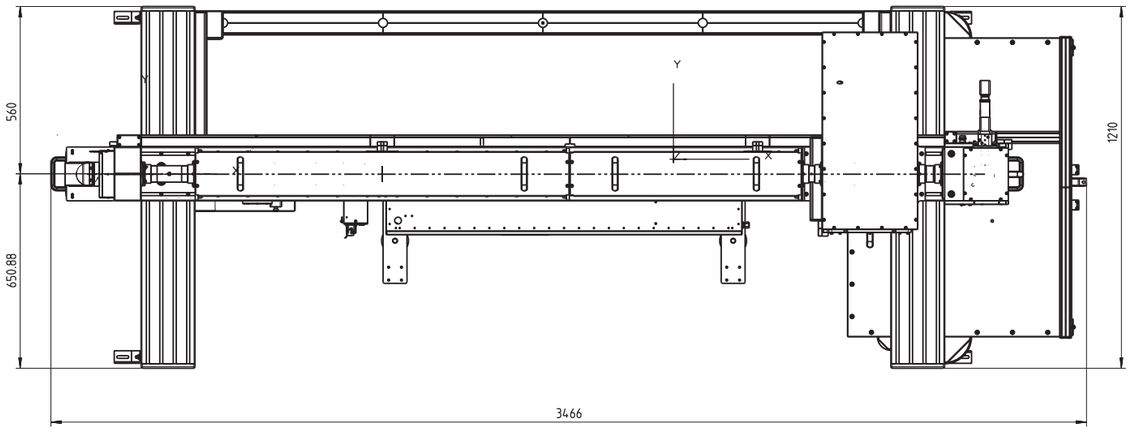
VarioLas Standard with Options Installed



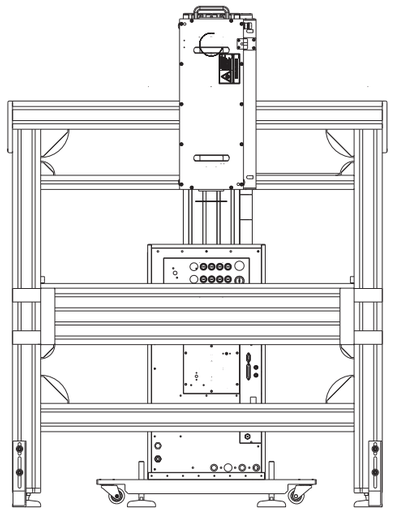


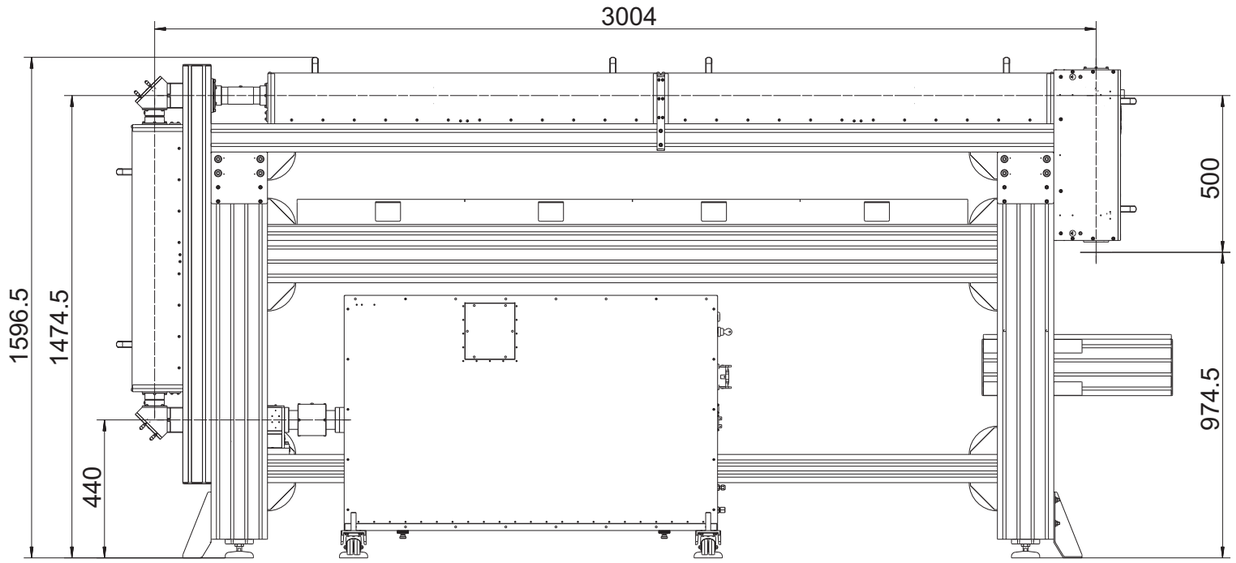


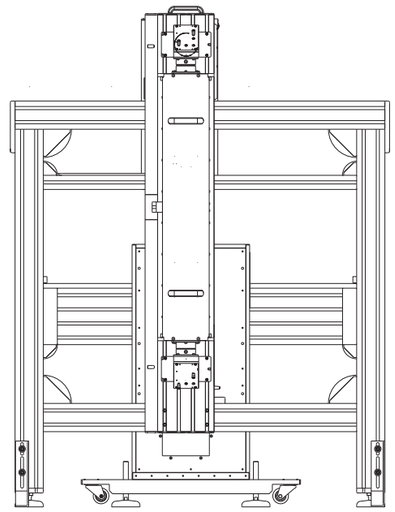


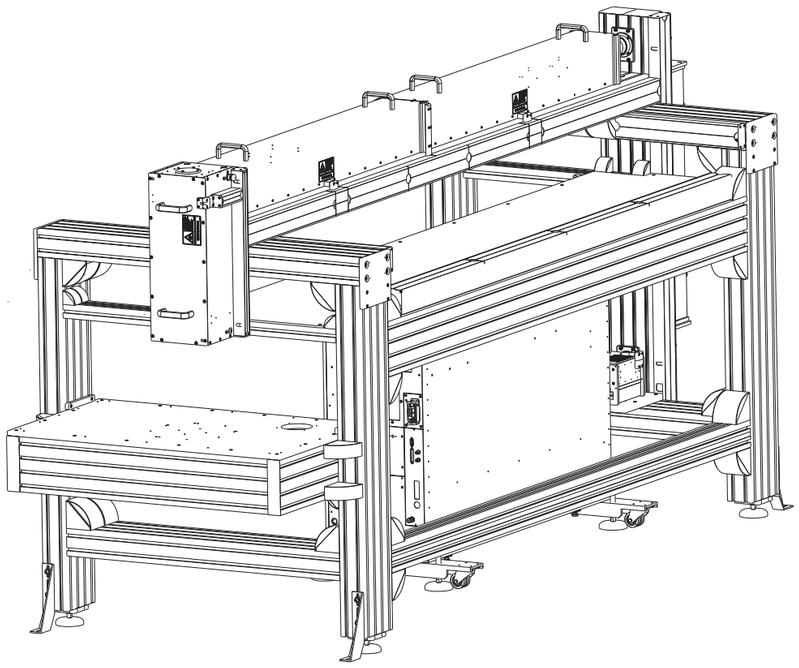


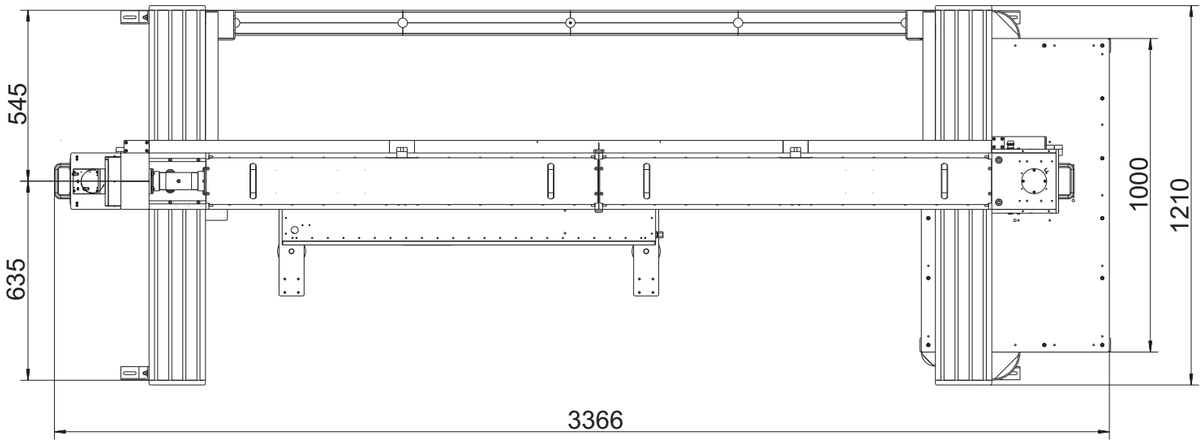
VarioLas Standard without Options



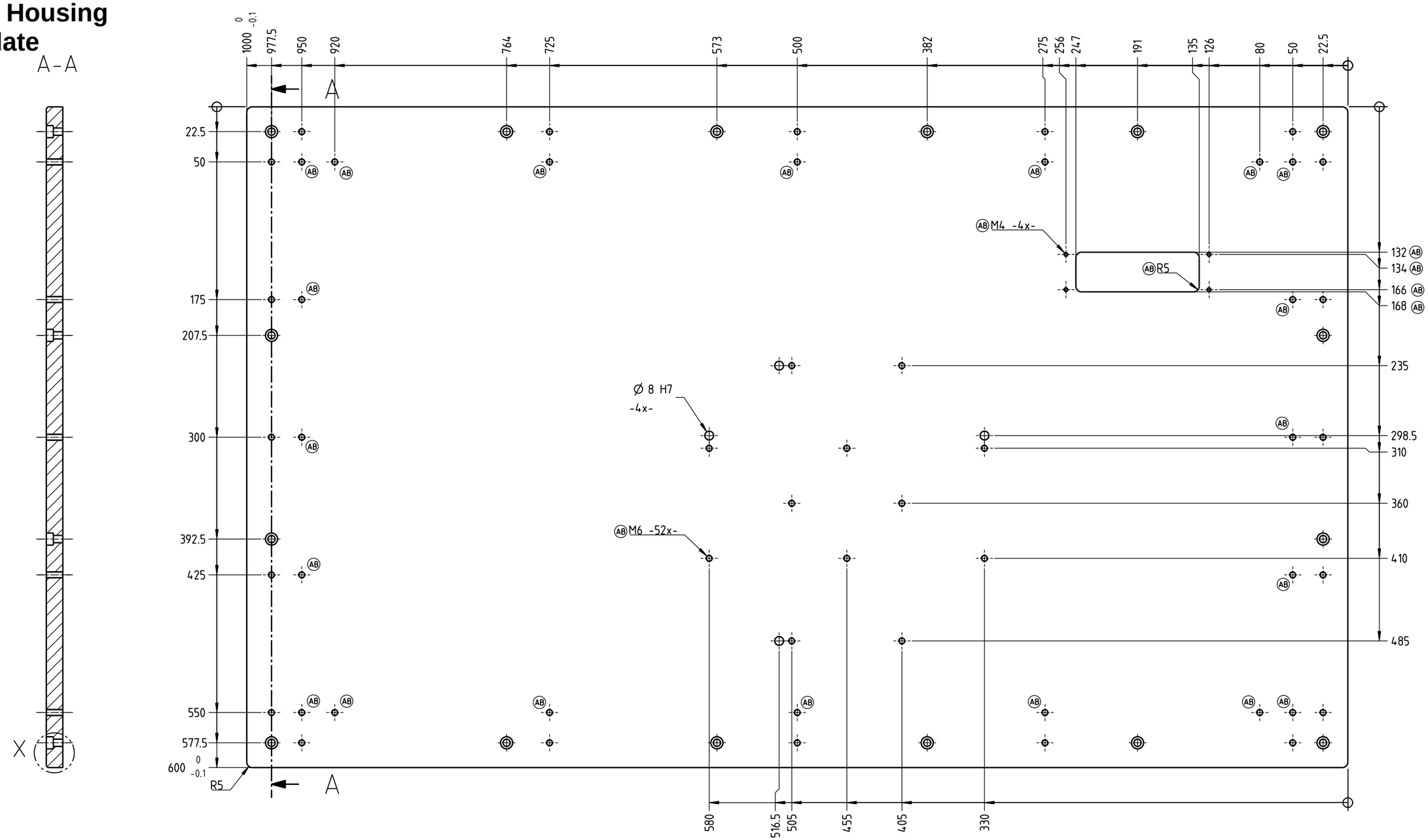








Class 1 Housing Base Plate



Oberflächenzustand EV1					Oberfläche DIN ISO 1302	zul Abw n DIN 7168 mittel	MaStab 1:2.5	Art Nr 1161008
Verwendungszweck/Baugruppe							Werkstoff 3.3206 AlMgSi0.5(F22) MCX1001	
Ind	ÄM-Nr	Änderung	Datum	Name		Datum	Name	Benennung
					Bearb	06.11.2008	sbg	Basisplatte
					Gepr	04.10.2010	sbg	
AB	10344-01	M6 hinzu, Ausfräsung geändert	29 09 2010	sbg				
AA	08324-01	Ersterstellung	06 11 2008	sbg				

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Blatt 1 / 1 Bl

Ers f | Ers d